Ministry of Education

Time:
2 hours

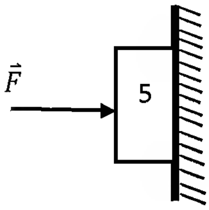
The experimental test for the third secondary stage
in statics
In the academic year 2014 – 2015

(الاسئلة في صفحتين) يسمح باستخدام الالة الحاسبة

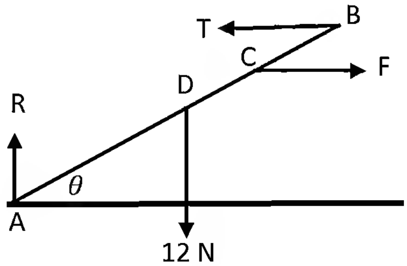
First: Answer the following question (mandatory):

First question: complete the following statements to be correct:

1) *Two couples are equivalent if ....*
2) *If θ is the measure of the angle included between the two vectors $\vec{A}$, $\vec{B}$ and* $|| \vec{A} \times \vec{B} || = \vec{A} \odot \vec{B}$ *,then θ = ...*
3) *Two parallel forces whose magnitudes are F , 15 newton act at two points A and B respectively where their resultant equals 10 newton and acts in the same direction of the force $\vec{F}$ .then F= ....*
4) *The magnitude of the smallest horizontal force that makes a body of mass 5 kg. in equilibrium on a vertical rough wall where the coefficient of friction between them equals $\frac{1}{3}$ equals ....kg. wt.*



5) *If $\overrightarrow{f_1}$ and $\overrightarrow{f_2}$ are two parallel forces such that: $\overrightarrow{f_1}$ = (1 , m) and $\overrightarrow{f_2}$ = (m^2 , -8) then the algebraic components of $\overrightarrow{f_1}$ in direction of $\overrightarrow{f_2}$ equals ....*
6) *In the opposite figure : AB is a uniform rod whose weight is 12 newton , $\sin\theta = \frac{3}{5}$ C is the midpoint of $\overline{BD}$ .If the rod is equilibrium under the effect of two couples. then: F + T + R = ...*



Second: Answer three of the following questions:

Second question:

a) *A body whose weight is W newton is placed on a rough plane inclined at angle of measure θ to the horizontal and the measure of the angle of friction is λ. Where $\theta > \lambda$. A force acts on the body in the direction of the line of the greatest slope to prevent the body from slipping. Prove that the least magnitude of the force is* $\frac{\sin(\theta - \lambda)}{\cos\lambda} W$

b) *The force $\vec{f} = 2\vec{i} + 1.5\vec{j}$ acts at the point A (5 , -1) .Calculate the moment of the force $\vec{f}$ about the points B(2 , 3) , D(-2 , 0) ,then show that the line of action of the force $\vec{f}$ is parallel to $\overleftrightarrow{BD}$*

باقى الاسئلة فى الصفحة التالية

Third question:

a) *Three forces equal in magnitudes act at the vertices of a triangle in the same direction prove that the resultant of these forces acts at the intersection point of the medians of the triangle .*

b) *A uniform ladder AB of weight W and length L rests in a vertical plane with its end A against a smooth vertical wall and with its end B on a rough horizontal floor . The coefficient of friction between the ladder and the floor equals $\frac{4}{3}$. If the ladder inclined to the horizontal by an angle of measure θ where $\tan\theta = \frac{1}{2}$ .Find the furthest point from B on the ladder in which a weight twice the weight of the ladder will be hanged and the ladder still in equilibrium.*

Fourth question:

a) *AB is a uniform rod of weight 20 newton and length 50 cm can rotate easily in a vertical plane around a hinge fixed at A , A couple of magnitude 250 newton.cm and whose direction is perpendicular to the plane of the rod acts on the rod .*
Find in the position of equilibrium the magnitude and the direction of the reaction of the hinge and the inclination of the rod to the horizontal.

b) *In ΔABC , $M \in \overline{AB}$ such that AM : MB = 1 : 2 , , $N \in \overline{AC}$ such that AN : NC = 2 : 1*
IF $\overrightarrow{AN} \times \overrightarrow{MN} = \overrightarrow{AC} \times K\ \overrightarrow{BC}$ where $k > 0$, find the value of the constant K

Fifth question:

a) *AD is a non-uniform rod rests horizontally on two smooth supports B , C such that :*
AB = BC = CD , If a weight of 5 kg. wt. is suspended from A or if a weight of 10 kg. wt. is suspended from D the rod is about to rotate .Find the weight of the rod and prove that the point of application of weight divides the rod at ratio 4 : 5 form from A.

b) *ABC is a right angled triangle at B , AB = 3 cm , BC = 4 cm , forces of magnitudes 12 , 16 , 20 newton act on the directions $\overrightarrow{AB}$, $\overrightarrow{BC}$, $\overrightarrow{CA}$ respectively , prove that the system equivalent to a couple then find the magnitude of its moment also find the magnitude of the two forces act at A and C perpendicular to $\overrightarrow{AC}$ to equilibrium with the given forces .*